American Journal of Industrial Medicine 9:281–287 (1986)

Cancer Risk Among Artistic Painters

Barry A. Miller, MSPH, Debra T. Silverman, ScD, Robert N. Hoover, MD, and Aaron Blair, PhD

An association between bladder cancer and employment as an artistic painter was found in two study populations. A proportionate mortality analysis of death certificates of professional artists indicated a greater than twofold excess for bladder cancer mortality among painters. This association was further investigated in a large case-control interview study of bladder cancer patients where an overall relative risk estimate of 2.5 was found among artistic painters. Excess deaths from leukemia and arteriosclerotic heart disease also occurred in the proportionate mortality study. Information was not available to determine exposure to specific substances that may have been responsible for these observations; however, efforts should be made to limit exposure to art materials known to be hazardous.

Key words: artists, painters, cancer, bladder, leukemia, proportionate mortality, case control

INTRODUCTION

Artists may be exposed to a variety of hazardous substances during the course of their work, though they have not traditionally been considered a high-risk occupational group. Historically, painters have worked with inorganic pigments containing lead, mercury, cadmium, chromium, carbon black, and arsenic compounds. Since the early 1900s, synthetic organic pigments and solvents have become widely used. Known or suspected carcinogens to which artists may be exposed include 2-naphthylamine, polychlorinated biphenyls, benzidine, formaldehyde, and asbestos in art paints and benzene, dioxane, and methylene chloride as solvents [McCann, 1979; Helper et al, 1979; Jenkins, 1980]. Professional artists frequently work 40 or more hours per week and sometimes eat and sleep in inadequately ventilated studios without appropriate personal protective equipment [McCann, 1978]. This results in potentially prolonged exposure to hazardous substances via inhalation, dermal absorption, and ingestion.

To determine if artists are at increased risk of mortality from specific causes that might be related to hazardous occupational exposures, we conducted 1) a proportionate mortality analysis of artist deaths and 2) a case-control analysis of artistic painters (hereafter referred to as "painters") identified in a large population-based bladder cancer study [Hoover and Strasser, 1980].

Epidemiology and Biostatistics Program, National Cancer Institute, National Institutes of Health, Bethesda, Maryland

Address reprint requests to Barry A. Miller, National Cancer Institute, Landow 4C16, Bethesda, MD 20892.

Accepted for publication September 17, 1985.

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METHODS

Proportionate Mortality Study

The proportionate mortality study group was identified from artists' obituaries published in *Who's Who in American Art* for the years 1940 through 1969 [Gilbert, 1947–1969]. This was the only time period for which sufficient information was available on study subjects to obtain death certificates. The underlying cause of death recorded on the death certificate was coded by an experienced nosologist to the 7th revision of the ICD, according to the rules in effect at the time of death [World Health Organization, 1957].

Based on obituary information, an artist was classified according to predominant activity as either a painter or "other artist." The latter group consisted largely of museum administrators, collectors, dealers, writers, and critics (N = 247) believed to have little exposure. Smaller numbers of illustrators (N = 214), architects (N = 187), sculptors (N = 149), and printmakers (N = 61) were also included. Data were not available to determine the length of time individuals spent practicing their art. All entries are screened by editors and art consultants. Those selected for publication tend to be established artists and it is reasonable to assume that they worked for several years in their field.

The observed number of deaths among artists caused by a specific underlying cause was compared to the number of deaths that would have been expected to occur for this cause, based on the distribution of deaths in the general U.S. population. Appropriate adjustments were made in the calculation of the expected number of deaths for the age, race, sex, and calendar time composition of the study group. The observed number of deaths was then divided by the expected number and presented as the proportionate mortality ratio (PMR). To derive expected numbers of deaths for specific leukemia cell types, age-adjusted proportionate mortality in the U.S. white male population for the year 1970 was used, since this is the earliest year for which national data are available. Additional comparisons were made between observed and expected numbers of site-specific cancer deaths based on their distribution among the total number of cancer deaths for all cites combined. This provided a measure of association that may be a better indicator of true risk, since it would likely be less affected by a difference between the overall death rate of the study group and the comparison population [Wong and Decouflé, 1982]. These ratios of observed to expected numbers of cancer deaths are presented as proportionate cancer mortality ratios (PCMR). Expected numbers of cancer deaths were calculated using proportions of site-specific cancer deaths in the general U.S. population and in the New York City population (five-county area, where 25% of the painters last resided) with appropriate adjustments for race, sex, age, and calendar time. Two-sided 95% confidence intervals (CI) were calculated for all PMR and PCMR using Miettinen's test-based formula [Miettinen, 1976].

Case-Control Study

. Data from a large case-control interview study were used to investigate bladder cancer risks among painters. These data provided the opportunity to investigate a more contemporary group of artists, to control for the effects of smoking habits, and to evaluate the relationship of duration of employment as a painter with bladder cancer risk. The study design has been described in detail elsewhere [Hartge et al,

1984]. Briefly, cases consisted of all residents in ten geographic areas in the United States, aged 21–84 years, who were newly diagnosed with a histologically confirmed carcinoma of the urinary bladder during a 1-year period beginning in December 1977. Controls were an age- and sex-stratified random sample of the general populations in these areas. The list of materials the subjects reported using in each job held for at least 6 months was evaluated to determine exposure to paint. Subjects were considered "exposed" if they were ever employed as an artist and had worked with paint. Twenty-seven subjects met these exposure criteria: 18 men and 9 women. Since all the exposed subjects were white, analyses were restricted to white study subjects.

The measure of association used was the relative risk as estimated by the odds ratio. Summary relative risks were computed by the maximum likelihood method [Gart, 1970]; a 95% confidence interval was calculated by use of a test-based estimation procedure [Miettinen, 1976]. A two-tailed significance test for trend was computed by the Mantel extension of the Mantel-Haenszel procedure [Mantel, 1963].

RESULTS

Proportionate Mortality Study

Death certificates were located for 1,757 artists, or 82% of the intended study group. Mortality findings are presented for 1,746 white artists because of the small number of nonwhite artists. There were 890 painters (630 men, 260 women) and 856 "other artists" (742 men, 114 women). Detailed mortality findings for specialties within this "other artists" group appear in an earlier preliminary report [Miller et al, 1985].

The geographic distribution of painters was similar for both sexes. Sixty-seven percent of the deaths occurred in the northeastern United States. Deaths in New York state included 233 men (67% of these in New York City) and 94 women (69% of these in New York City). The median ages at death for male and female painters were 72 and 74 years, respectively.

Few differences in the PMR for selected causes of death were found between male and female painters, so results for the two sexes are combined (Table 1). Deaths from all cancer sites combined and arteriosclerotic heart disease were significantly elevated. There were also significant relative deficits in mortality from "other circu-

TABLE I. Mortality Experience of Painters: Males and Females Combined

Underlying cause of death[a]	OBS	EXP[b]	PMR[c]	95% CI
All causes	890	890.0	1.0	—
All cancer (140–205)	187	136.4	1.4	1.2–1.6
Diabetes mellitus (260)	12	18.6	0.6	0.4–1.1
Arteriosclerotic heart disease (420)	276	218.2	1.3	1.2–1.4
Other circulatory disease (400–419, 421–468)	146	195.4	0.7	0.6–0.9
Respiratory disease (470–527)	35	40.0	0.9	0.6–1.2
Digestive system disease (530–587)	36	33.3	1.1	0.8–1.5
Genito-urinary system disease (590–639)	22	42.4	0.5	0.4–0.8
Accidents (800–962)	25	37.9	0.7	0.4–1.0
Suicide (963, 970–979)	14	8.9	1.6	0.9–2.6
Other causes	137	158.9	0.9	0.7–1.0

CI, confidence interval; EXP, expected; OBS, observed; PMR, proportionate mortality ratio.
[a]Numbers in parentheses are classification numbers of the World Health Organization [1957].
[b]Expected number of deaths based on age- and time-specific proportionate mortality of U.S. white population.
[c]OBS/EXP.

latory disease" and genitourinary system disease. This general mortality pattern was seen in the remaining group of "other artists," though the total cancer excess was smaller, with 160 observed deaths (PMR = 1.2, 95% CI = 1.0–1.4).

Small numbers precluded analyses of site-specific cancer deaths among women, so the remaining results are presented only for men. Leukemia and cancers of the bladder, kidney, and colorectum were significantly elevated among male painters (Table II). There was a slight deficit of deaths from stomach cancer. The leukemia excess among male painters was most pronounced for the myeloid cell type, with six observed deaths (PMR = 4.0, 95% CI = 1.7–9.2). PMR among the "other artists" were not significantly elevated for leukemia (PMR = 1.4, 95% CI = 0.6–3.3) and bladder cancer (PMR = 1.0, 95% CI = 0.4–2.5), but were increased for colorectal cancer (PMR = 1.6, 95% CI = 1.1–2.4) and kidney cancer (PMR = 3.2, 95% CI = 1.6–6.5).

When PCMRs were used as a measure of association, all of the risk estimates were reduced (Table II). However, the overall pattern of site-specific cancer mortality was similar, and deaths from bladder cancer and leukemia remained significantly elevated among male painters. Comparisons with New York City proportionate cancer mortality also supported the excess risk of bladder cancer (NYC PCMR = 2.4, 95% CI = 1.4–4.2) and leukemia (NYC PCMR = 2.7, 95% CI = 1.4–5.1). The elevated risks for colorectal cancer seen among painters and other artists in the PMR analysis were not seen in the proportionate cancer mortality analysis. The New York City PCMR for colorectal cancer was 1.2 and 1.1 for painters and other artists, respectively. The elevated risks seen for kidney cancer in both painters and other artists remained in the PCMR analysis, although they were reduced to approximately twofold.

Case-Control Study

Data from the large case-control study of bladder cancer demonstrated a smoking-adjusted relative risk among painters of 2.5 (95% CI = 1.1–5.7). A significant trend in risk was apparent with increasing duration of employment as a painter (Table III).

TABLE II. Cancer Mortality of Painters: Males

Underlying cause of death[a]	OBS	EXP[b]	PMR[c]	95% CI	EXPC[d]	PCMR[e]	95% CI
All cancer (140–205)	125	91.9	1.4	1.2–1.6	125.0	1.0	—
Stomach (151)	8	12.2	0.7	0.3–1.3	16.6	0.5	0.3–1.0
Colorectum (153–154)	28	14.7	1.9	1.3–2.8	20.0	1.4	0.9–2.1
Lung (162–163)	17	14.8	1.2	0.7–1.8	20.1	0.8	0.4–1.7
Prostate (177)	17	11.6	1.5	0.9–2.3	15.6	1.1	0.5–2.5
Kidney (180)	5	1.8	2.8	1.2–6.5	2.6	1.9	0.7–5.5
Bladder (181)	14	4.0	3.5	2.1–5.7	5.4	2.6	1.5–4.4
Leukemia (204)	10	3.2	3.1	1.8–5.6	4.4	2.3	1.2–4.5
Other cancer	26	29.6	0.9	0.6–1.3	40.4	0.6	0.4–0.9

[a]Numbers in parentheses are classification numbers of the World Health Organization [1957].
[b]Expected number of deaths based on age- and time-specific proportionate mortality of U.S. white male population.
[c]OBS/EXP.
[d]Expected number of deaths based on age- and time-specific proportionate cancer mortality of U.S. white male population.
[e]OBS/EXPC.

TABLE III. Bladder Cancer Risk by Duration of Employment as a Painter: Males and Females Combined*

Duration	Cases	Controls	RR[a]
Never	2,316	4,513	1.0
< 10 years	4	5	1.7
10+ years	11	7	3.0

*$\chi = 2.49$; $p = 0.01$.
[a]Relative to a risk of 1.0 for subjects never employed as painters and never exposed to paint in other occupations; adjusted for smoking.

DISCUSSION

Increased mortality from certain cancers and arteriosclerotic heart disease was found among artistic painters in the proportionate mortality study. In particular, relative excesses of greater than twofold were seen for bladder cancer and leukemia among male painters. No excess risks were noted for these two sites among other artists. Interpretation of proportionate mortality analyses is subject to limitations that have been described by others [Monson, 1974; Redmond and Breslin, 1975; Breslow, 1977; Kupper et al, 1978; Decouflé et al, 1980; Miettinen and Wang, 1981]. The intention here was to generate hypotheses that could be further tested in more analytic studies.

We had the opportunity immediately to test the bladder cancer finding with data from a recently completed case-control study. The relative risk estimate, adjusted for potential confounding by smoking habits, was 2.5. This was remarkably similar to the proportionate mortality findings. In addition, a significant trend in risk was observed with increasing duration of employment, providing further support for an association between bladder cancer and employment as an artistic painter.

The rubric used in the proportionate mortality study for kidney cancer deaths includes some lower urinary tumors that, in etiologic investigations, might more usefully be classified with bladder cancer deaths [Morrison and Cole, 1976]. Of the five kidney cancer deaths among male painters, one was specified as cancer of the renal pelvis and one as cancer of the right ureter.

Epidemiologic data regarding mortality among artists are sparse. Previous studies are limited to death certificate surveys where all art specialties were grouped into a single category. However, several findings from these studies support those presented here. Elevated mortality was reported for arteriosclerotic heart disease [Guralnik, 1963], leukemia [Registrar General, 1971], and colon cancer [Petersen and Milham, 1980]. Several studies have shown an association between employment as a structural painter and bladder cancer [Wynder et al, 1963; Cole et al, 1972; Decoufle et al, 1977; Miller, 1977]. Elevated mortality from leukemia was also reported for structural painters [Viadana and Bross, 1972; Englund, 1980] and paint production workers [Morgan et al, 1981].

It was not possible in this study to establish a connection between specific substances used by artists and cancer mortality because such information was not available. However, artists are known to be exposed through inhalation, absorption through skin, and ingestion to numerous toxic materials and other substances whose carcinogenicity is suspected or unknown [McCann, 1979]. Efforts should be made to limit exposure to hazardous art materials and future studies should investigate rela-

tionships between specific exposures and chronic health effects. These efforts seem warranted, in a public health sense, because of the large population of hobbyists using art materials, in addition to professional artists.

ACKNOWLEDGMENTS

We thank the Center for Occupational Hazards—Art Hazards Project, the research staff of *Who's Who in American Art*, and all contributing state vital records offices for their participation.

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